SAMSUNG DISPLAY

Product Specification

(√) Preliminary Specification
( ) Approval Specification

The information described in this SPEC is preliminary and can be changed without prior notice

CUSTOMER	DELL
DATE OF ISSUE	2013.02.20

MODEL NO.	LTN156AT34
EXTENSION CODE	-D

Customer Approval & Feedback

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LCD Sales & Marketing Team Samsung Display Co., Ltd	

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REVISION HISTORY

Date.	Rev.No.	Page	Revision Description
01/31/13	P00	All	Initial Release
02/20/13	P01	All	Model code was modified.

1. GENERAL DESCRIPTION

DESCRIPTION

The LTN156AT34-D uses a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFTs as switching components. This model is composed of a TFT LCD panel, a driver circuit, and a backlight unit. This 15.6" model has a resolution of 1366 x 768 pixels and can display up to 262,144 colors.

FEATURES

High contrast ratio
HD (1366 x 768 pixels) resolution
Low power consumption
Fast Response
LED back light with an embedded LED driver
DE (Data enable) only mode
3.3V LVDS interface
Onboard EEDID chip

APPLICATIONS

Notebook PC
If the intent to use this product is for other purpose, please contact Samsung Display.

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	344.232 (H) x 193.536 (V) (15.6"diagonal)	mm	
Driver Element	a-Si TFT active matrix		
Display colors	262,144 (6bit)		
Number of pixel	1366 * 768	Pixel	16:9
Pixel Arrangement	RGB vertical stripe		
Pixel pitch	0.252 (H) x 0.252 (V) (TYP.)	mm	
Display Mode	Normally white, TN mode		
Thickness of glass	0.5	mm	
Surface treatment	TBD		Glare
Environmental safe regulation	Pb Free, Halogen Free		

MECHANICAL INFORMATION

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	359.0	359.5	360.0	mm	
	Vertical (V)	223.3	223.8	224.3	mm	with flange
		206.0	206.5	207.0	mm	w/o flange
	Depth (D)	-	-	3.2	mm	(1)
Weight		-	-	380	g	

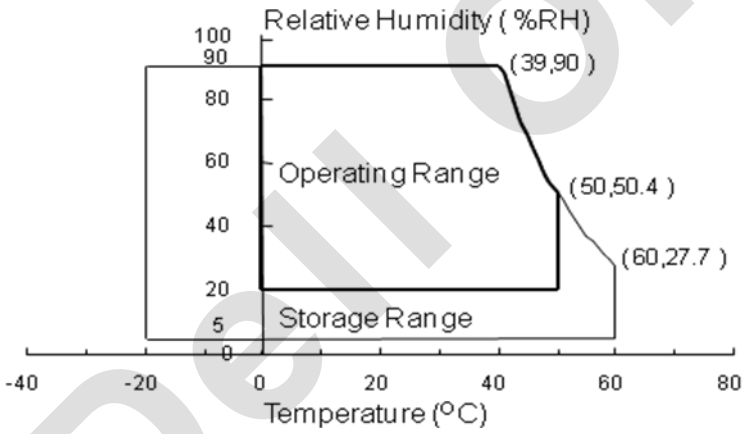
NOTE (1) Measuring method for thickness
Force to be applied for measurement : The 200gf when using the height gauge

2. ABSOLUTE MAXIMUM RATINGS

2.1 ENVIRONMENTAL ABSOLTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1)
Operating temperature (Temperature of glass surface)	TOPR	0	50	°C	(1)
Shock (non-operating)	Snop	-	240	G	(2), (4)
Vibration (non-operating)	Vnop	-	2.41	G	(3), (4)

Note (1) The range of temperature and relative humidity are shown in the graph below 90% RH Max. . (39℃ ≥ Ta) If the temperature is higher than 40 ℃, the maximum temperature of wet–bulb shall be less than 39℃. No condensation



(2) Vibrate ±X, ±Y, and ± Z axis in the shape of the half sine wave one time for 2ms .
(3) Vibrate the X, Y, and Z randomly within a 5 - 500 Hz range for 30min.
(4) When testing a vibration and a shock, the fixture, which holds the module to be tested shall be hard and rigid in order for the the module not to be twisted or bent by the fixture.

2.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

V_{LCD_VCC} =3.3V, V_{SS} = GND = 0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{LCD_VCC}	V_{SS} - 0.3	TBD	V	(1),(2)
LVDS Input Voltage	V_{LVDS}	V_{SS} - 0.3	TBD		

Note (1) Within Ta (25 ± 2 °C)

(2) Permanent damage to the device may occur if exceed maximum values

.

(2) BACKLIGHT UNIT

VSS = GND = 0V

Item	Symbol	Min.	Max.	Unit	Note
BLU Supply Voltage	V_{BL_PWR}	V_{SS} - 0.3	26.5	V	(1), (2)
BLU Supply Current	I_{BL_PWR}	-	0.9	A	(1), (2) Vin=12V Duty 100%

Note (1) Within Ta (25 ± 2 °C)

(2) Permanent damage to the device may occur if exceed maximum values

2.3 THE OTHERS

(1) STATIC ELECTRICITY PRESSURE RESISTANCE

Item	Test Conditions	Remark
CONTACT DISCHARGE	150pF, 330Ω, ± 8kV, 200points, 1 time/point	Operating
AIR DISCHARGE	150pF, 330Ω, ± 15kV, 200points, 1 time/point	Operating

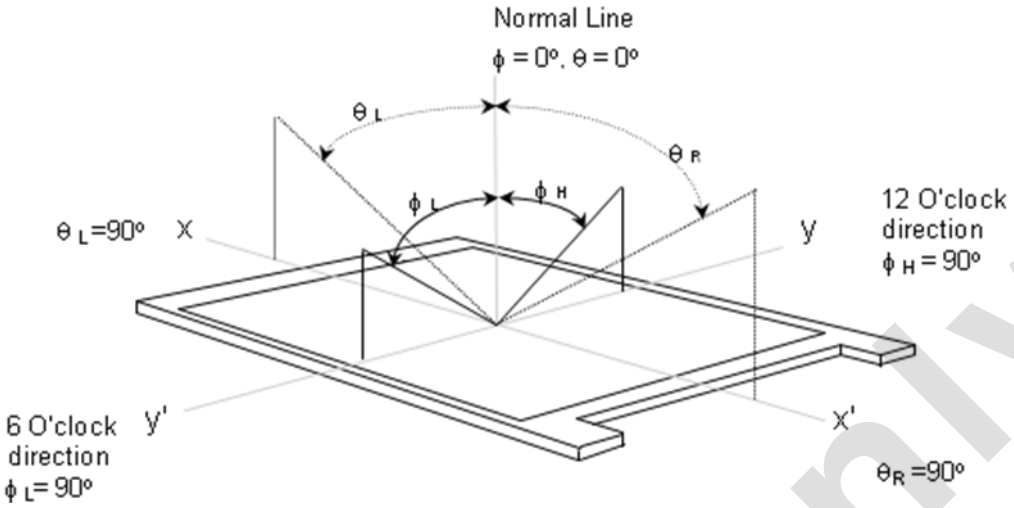
3. OPTICAL CHARACTERISTICS

The following items are measured under the stable conditions.* The optical characteristics should be measured in the dark room or the equivalent environment by the methods shown in the Note (5).
Measuring equipment : TOPCON SR-3

Ta = 25 ± 2 °C, V_{LCD_VCC} =3.3V, fv= 60Hz, fDCLK = (TBD)MHz, IF = 100% duty

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	Normal Viewing Angle $\phi = 0$ $\theta = 0$	500	-	-	-	(1),(2),(5)
Response time (Rising + Falling)		T_{RT}		-	16	25	msec	(1),(3)
Average Luminance of White (5 Points)		$Y_{L,AVE}$		170	200	-	cd/m^2	IF=100% Duty (1),(4)
Color Chromaticity (CIE)	Red	R_X		-0.03	TBD	+0.03		(1),(5)
		R_Y			TBD			
	Green	G_X			TBD			
		G_Y			TBD			
	Blue	B_X			TBD			
		B_Y			TBD			
	White	W_X			TBD			
		W_Y			TBD			
Viewing Angle	Hor.	θ_L	CR ≥ 10 At center	40	45	-	Degrees	(1),(5)
		θ_H		40	45	-		
	Ver.	ϕ_H		10	15	-		
		ϕ_L		30	35	-		
Color Gamut		CG		-	45	-	%	
White variation (13P)		δ_L		-	TBD			(6)

Note (1) The definition of viewing angle : The range of viewing angle (10 ≤ C/R)

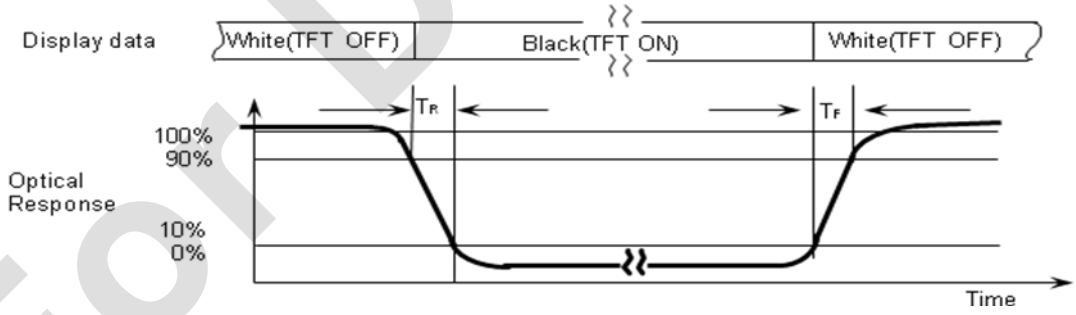


Note (2) The definition of contrast ratio (CR) : The ratio of max. gray and min gray at 5 points (33, 55, 77, 37, 73)

$$CR = \frac{CR(33) + CR(55) + CR(77) + CR(37) + CR(73)}{5}$$

Points : 33, 55, 77, 37, 73 at the figure of Note (6).

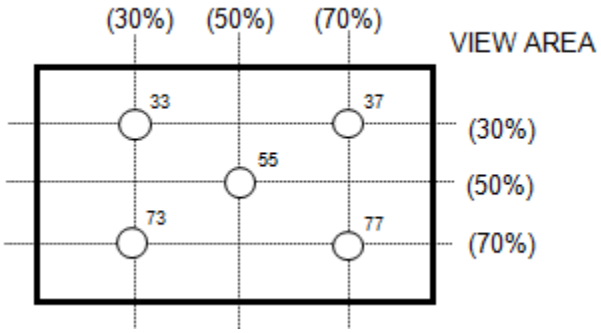
Note (3) The definition of Response time : Subtotal of the time, during which the transmission changes from 10% to 90% when the TFT turns on and off.



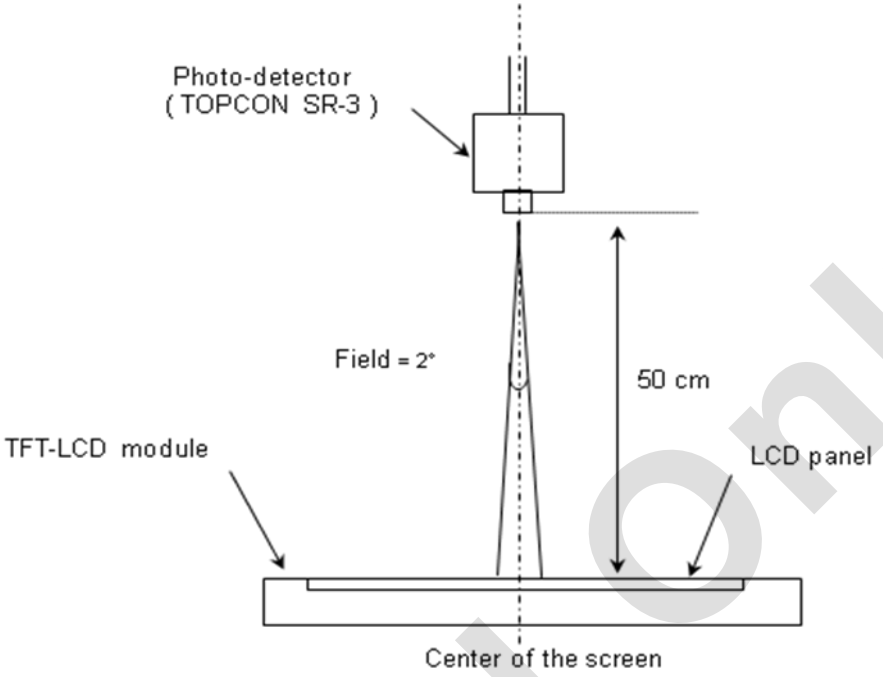
Note (4) The definition of average luminance of white : Measure the luminance of white at 5 points.

Average Luminance of White (Y_{LAVE})

$$Y_{LAVE} = \frac{Y_{L33} + Y_{L55} + Y_{L77} + Y_{L37} + Y_{L73}}{5}$$



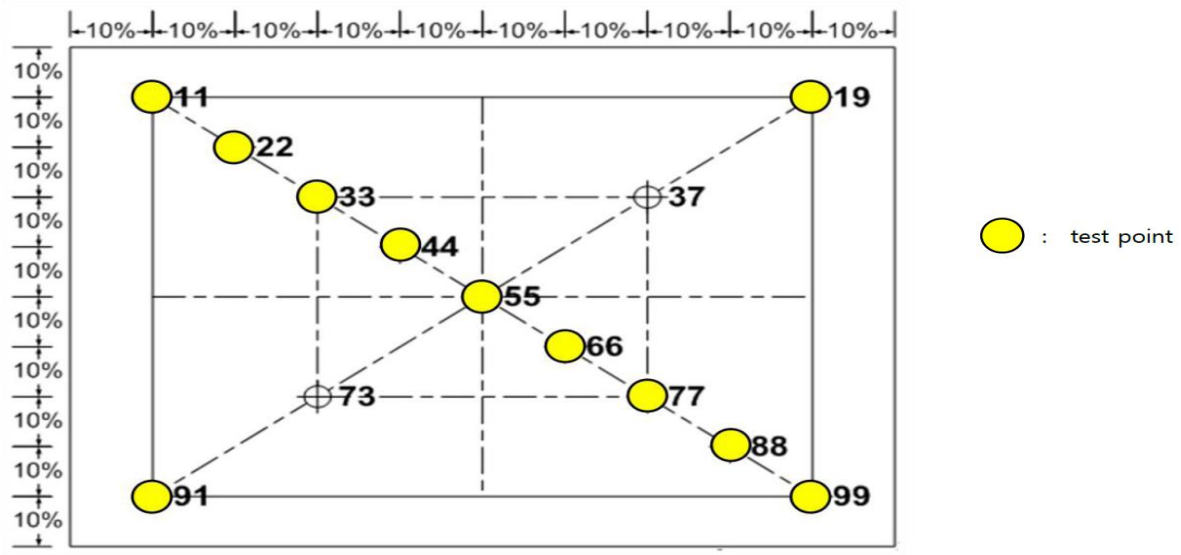
Note (5) Measure the panel, which is left for 30 min. at the normal temp. after leaving it for 30 min with turning the back light on at the rating. The measurement should be executed under the condition including the ambient temp., 25℃±2℃, the dark room, windless(removed the direct wind), and no vibration.



[Optical characteristics measurement setup]

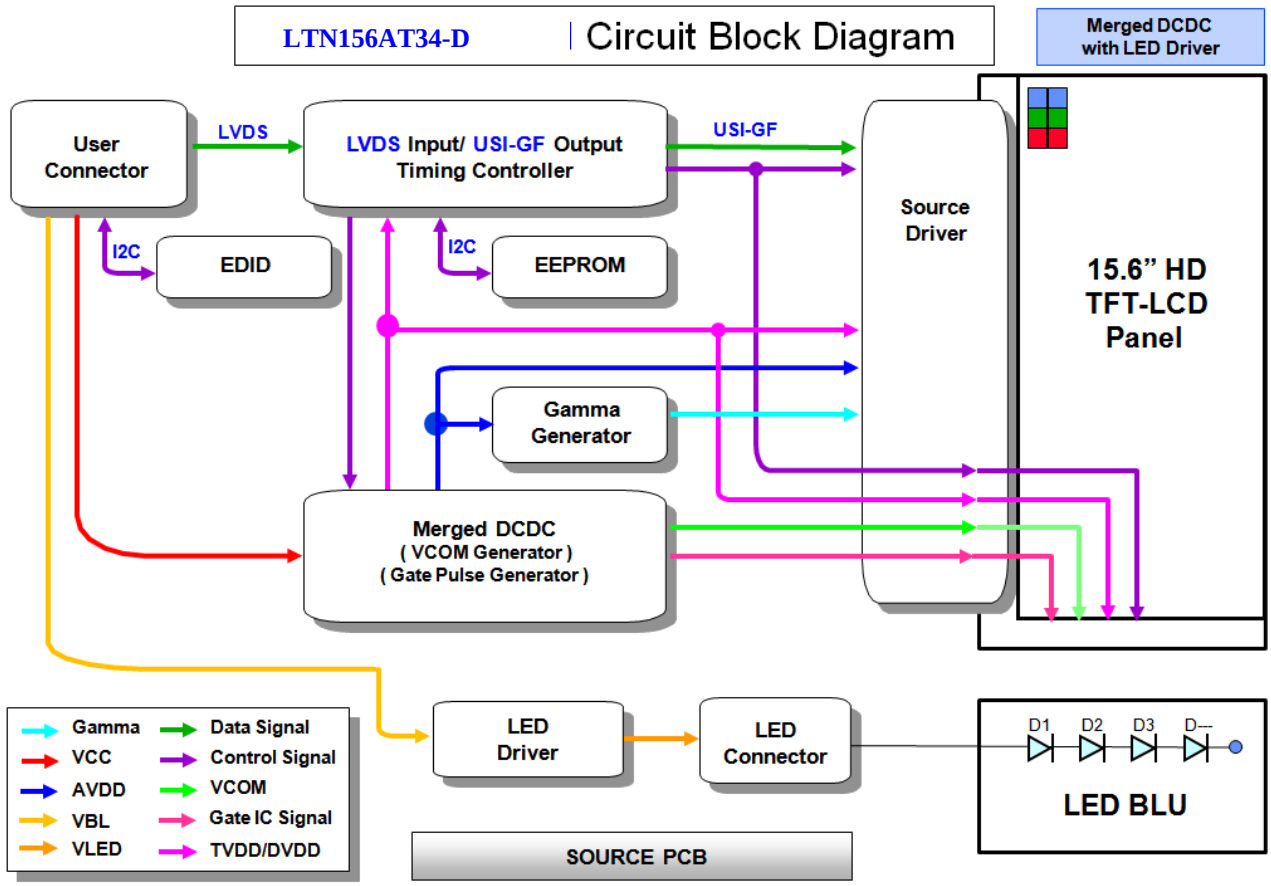
Note (6) The definition of white variation at 11 points (δ L): 11,22,33,44,55,66,77,88,99,19,91 point

$$\delta L = \frac{\text{Maximum luminance of 11 points}}{\text{Minimum luminance of 11 points}}$$



4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 THE STRUCTURE OF LED PLACEMENT

(TBD)

5. ELECTRICAL CHARACTERISTICS

5.1 TFT LCD MODULE

* Ta = 25 ± 2 °C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage		V_{LCD_VCC}	3.0	3.3	3.6	V	
T-CON TTL Input Voltage	High	V_{IH}		TBD		V	
	Low	V_{IL}		TBD		V	
Vsync	60Hz	fv		60		Hz	
Hsync	60Hz	fh		TBD		kHz	
Main Frequency	60Hz	fDCLK		TBD		MHz	
Rush Current		IRUSH		TBD		A	(5)
Input Current	White	I_{LCD_VCC}	-	TBD	-	mA	(4)
	Mosaic	I_{LCD_VCC}	-	TBD	-	mA	
	Black	I_{LCD_VCC}	-	TBD	-	mA	
	Red	I_{LCD_VCC}	-	TBD		mA	
	Green	I_{LCD_VCC}	-	TBD		mA	
	Blue	I_{LCD_VCC}	-	TBD		mA	

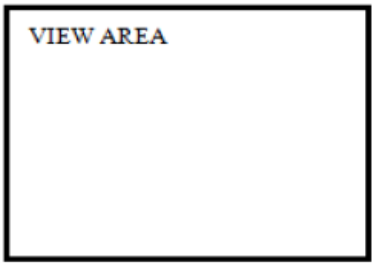
Note (1) The data pins for display and signal pins for timing should be connected.(GND= 0V)

(2) fV = 60Hz, fDCLK = (TBD) MHZ, V_{LCD_VCC} = 3.3V , DC Current.

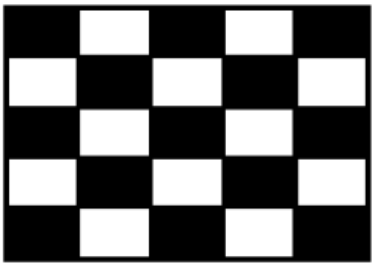
(3) In the case of 40Hz & 50Hz, FOS, Flicker & Brightness are not guaranteed, because their level might be different from 60Hz operation.

Note (4) The dissipation pattern for power

*a) White Pattern



*b) Mosaic Pattern



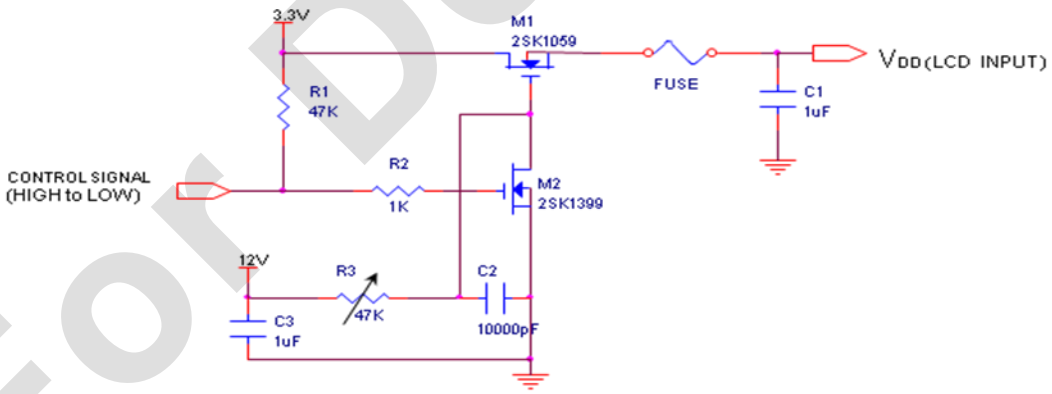
*c) Black Pattern

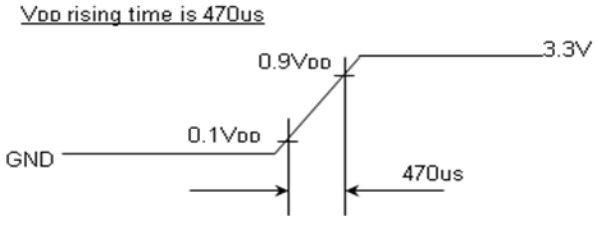
*e) Red Pattern

*f) Green Pattern

*g) Blue Pattern

Note (5) The condition for measurement for rush current





5.2 BACK LIGHT UNIT

Ta = 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF		TBD		mA	
LED Forward Voltage	VF		TBD		V	IF = TBD mA
LED Array Voltage	VP		TBD		V	VF * LED Counts
LED Power Consumption	P	-		2.6	W	
LED Life time	Hr	15,000	-	-	Hour	(1)
LED Counts	Q	-	TBD	-	EA	

Note (1) The life time (Hr) of LEDs can be defined as the time during which it continues to operate under the condition, which the Ta is 25 ± 2 °C and IF= TBD mArms until the one of the following events occurs when the brightness becomes 50% or lower than the original..

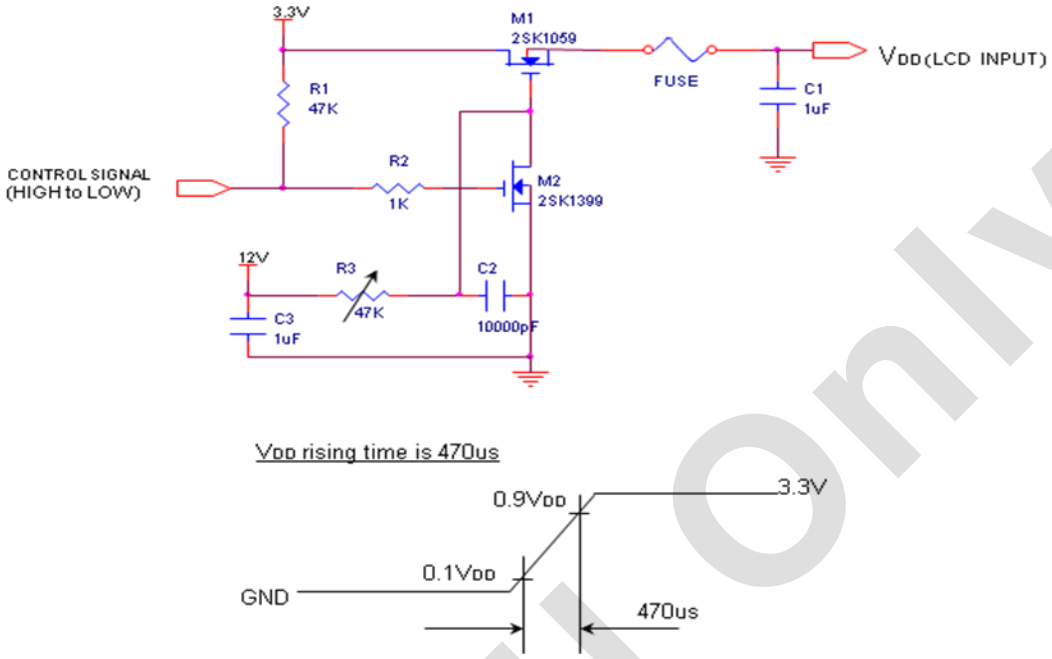
5.3 LED DRIVER

The manufacturer of LED driver: TBD

Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	V_{BL_PWR}		TBD		V	
Input Current	I_{BL_PWR}		TBD		mA	Vin=12V Duty 100%
PWM duty Ratio	$D_{BL\_PWM\_DIM}$		TBD		%	PWM : TBD
External PWM Frequency	$F_{BL\_PWM\_DIM}$		TBD		kHz	
In-Rush Current	$I_{RUSH\_BL\_PWR}$		TBD		A	(1)

Note (1) Rush current measurement condition



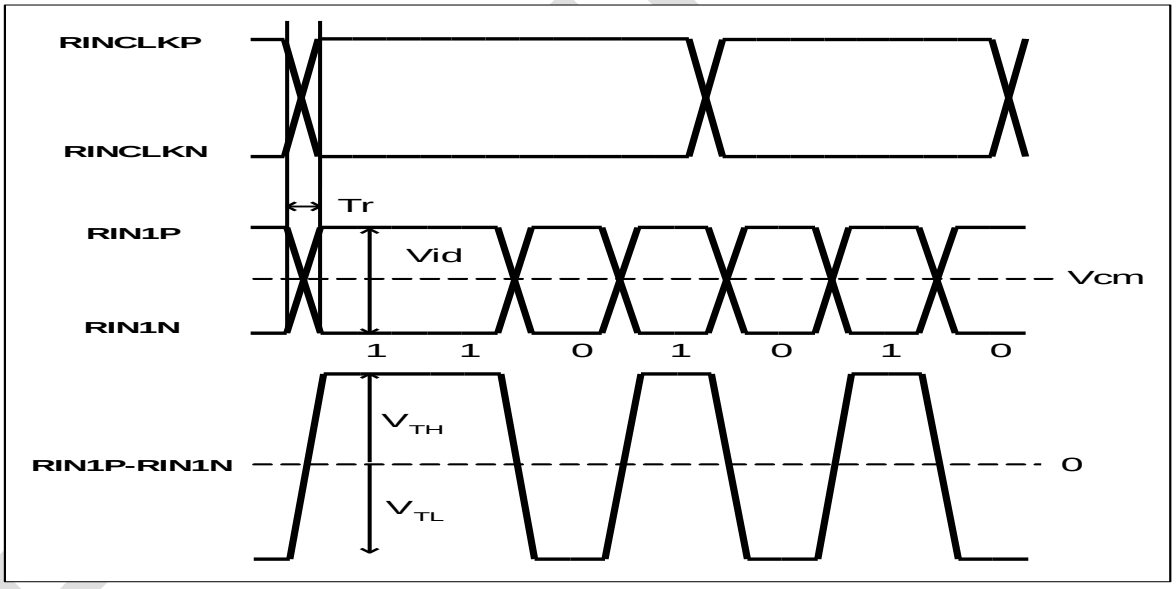
5.4 LVDS INTERFACE

LVDS DC Specifications

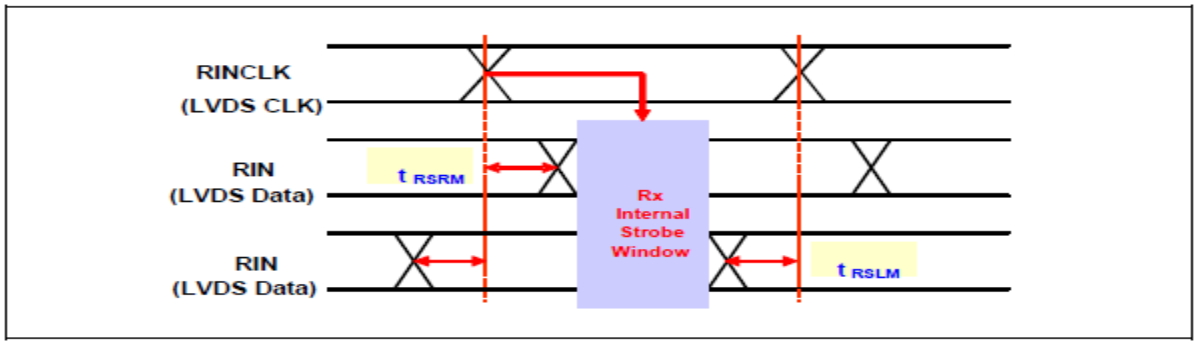
Characteristics	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential input high threshold voltage	V_{TH}	-	-	+200	mV	V_{CM} = 1.2V
Differential input low threshold voltage	V_{TL}	-200	-	-	mV	
Differential input voltage	$\|V_{ID}\|$	200	400	600	mV	
Common mode voltage	V_{CM}	0.4	1.2	1.8	V	$\|V_{ID}\|$= 100mV

LVDS AC Specifications

Characteristics		Symbol	Min.	Typ.	Max.	Unit	Remarks
ROUTCLK frequency		fRCP	(TBD)	(TBD)	(TBD)	Mhz	
LVDS RX Skew (Strobe) Right Margin	85MHz	T_{RSRM}	-	-	400	ps	
	50MHz		-	-	700	ps	
LVDS RX Skew (Strobe) Left Margin	85MHz	T_{RSLM}	-400	-	-	ps	
	50MHz		-700	-	-	ps	



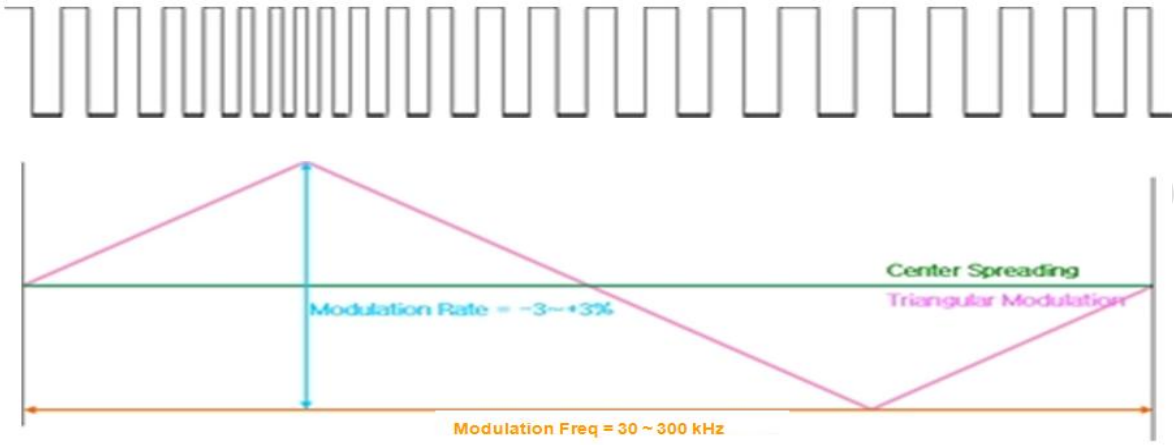
< The definition of LVDS DC characteristics >



< The definition of LVDS Receiver Skew (Strobe) Margin >

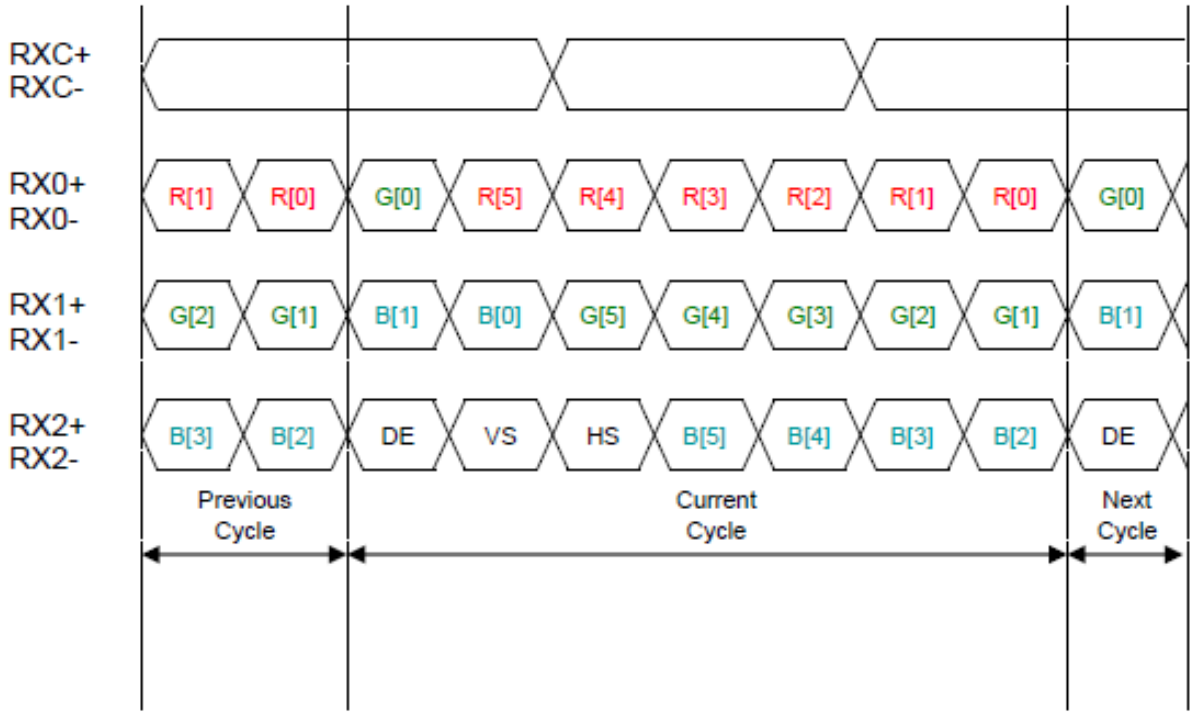
LVDS SSC Specification

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Remarks
Modulation Rate	Fmr	-3	0	+3	%	
Modulation Frequency	Fmf	30	-	300	kHz	@ MAINCLK = (TBD)MHz



< Definition of SSC (Spread Spectrum Clock) >

Timing diagrams of LVDS transmission

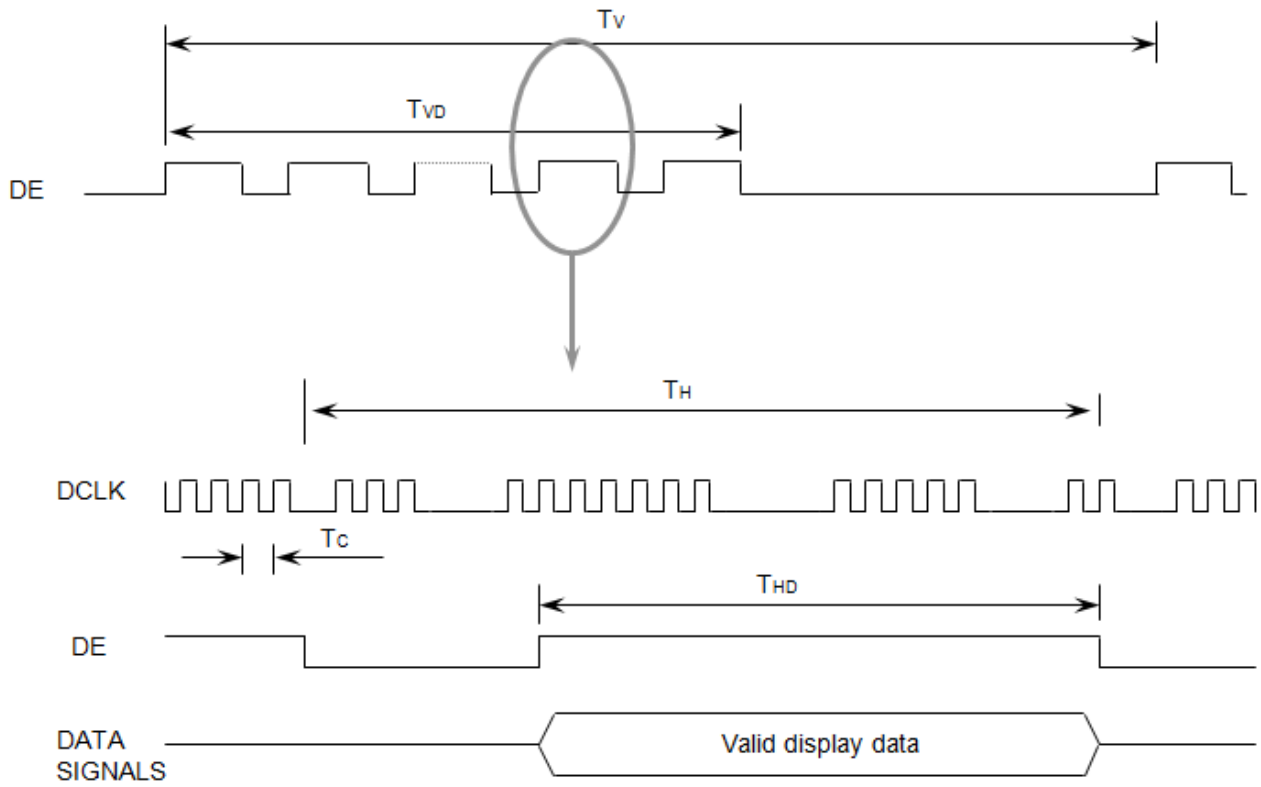


5.5 INTERFACE TIMING

5.5.1 TIMING PARAMETERS

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	T_V		TBD		Lines	
Vertical active in the display term	Display Period	T_{VD}	-	768	-	Lines	
Scanning time in one line	Cycle	T_H		TBD		Clocks	
Horizontal active in the display term	Display Period	T_{HD}	-	1366	-	Clocks	

5.5.2 TIMING DIAGRAMS OF INTERFACE SIGNAL



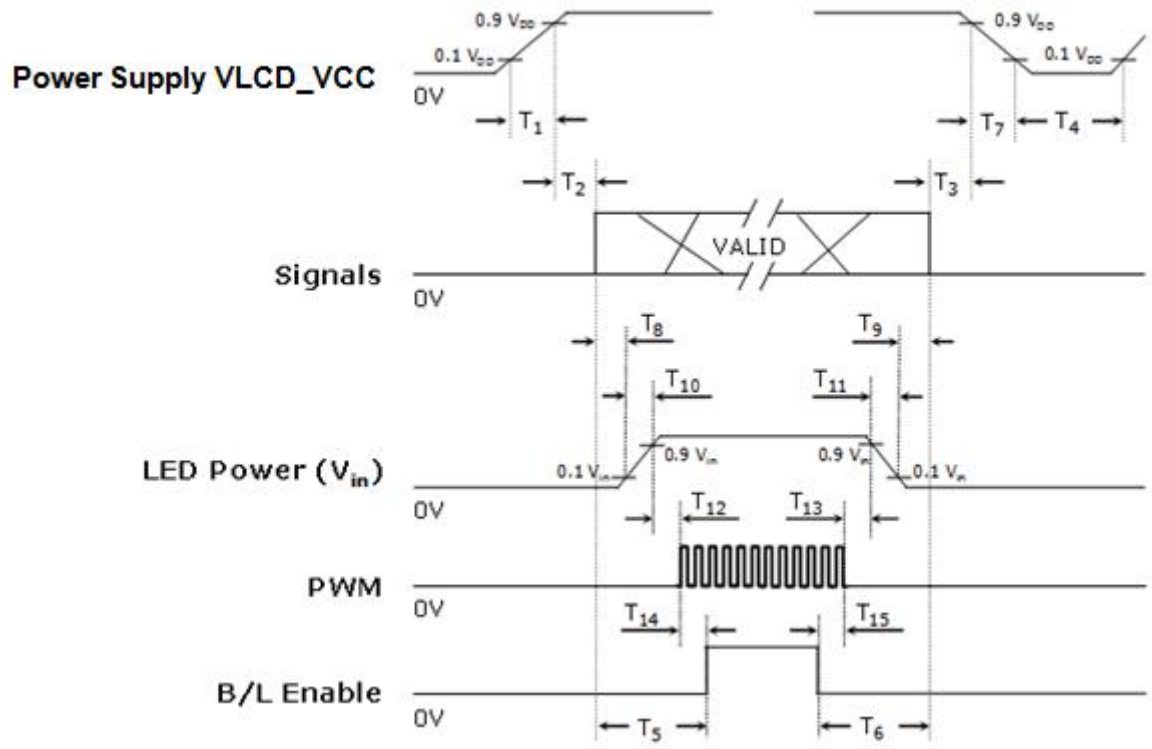
5.6 INPUT COLOR DATA MAPPING

Color	Display	Data Signal																		Gray Scale Level
		Red						Green						Blue						
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	45	B5	
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	-
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	-
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	-
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	-
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	-
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	-
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
Gray Scale Of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	Dark	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
	↑	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R61
	Light	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R62
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R63
Gray Scale Of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	Dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	G1
	↑	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G61
	Light	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	G62
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	G63
Gray Scale Of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	B1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B61
	Light	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B62
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B63

Note (1) Definition of gray : Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)
Note (2) Input signal: 0 =Low level voltage, 1=High level voltage

5.7 POWER ON/OFF SEQUENCE

To prevent the product from being latched up or the DC in the LCD module from starting an operation, the order to turn the power on and off should be changed to the order as shown in the diagram below.



Timing (ms)	Remarks
$0.5 < T_1 \leq 10$	VLCD_VCC rising time from 10% to 90%
$0 < T_2 \leq 50$	Interval from VLCD_VCC to valid data at power ON
$0 < T_3 \leq 50$	Interval from valid data OFF to VLCD_VCC OFF at power Off
$150 \leq T_4$	VLCD_VCC OFF time for Windows restart
$200 \leq T_5$	Interval from valid data to B/L enable at power ON
$0 \leq T_6$	Interval from valid data off to B/L disable at power Off
$0 < T_7 \leq 10$	VLCD_VCC falling time from 90% to 10%
$10 < T_8$	Interval from valid data on to LED driver Vin rising time 10%
$10 < T_9$	Interval from LED driver Vin falling time 10% to valid data Off
$0.5 < T_{10} \leq 10$	LED V_{in} rising time from 10% to 90%
$0.5 < T_{11} \leq 10$	LED V_{in} falling time from 90% to 10%
$0 < T_{12}$	Interval from LED driver Vin rising time 90% to PWM ON
$0 < T_{13}$	Interval from PWM Off to LED driver Vin falling time 10%
$0 \leq T_{14}$	Interval from PWM ON to B/L Enable ON
$0 \leq T_{15}$	Interval from B/L Enable Off to PWM Off

The backlight may be flashed if the interface signal remains floated when the above-mentioned signal becomes invalid.

Note (1) The power voltage from system shall be supplied to the input pin of LCD constantly.

(2) Enable the voltage to the LED within the range, which the LCD is operated. The screen becomes white when turning the back-light on before the LCD is operated or turning the LCD off before turning the back-light off. Operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

(3) Don't leave the system at a high impedance state, which the interface signal is out for a long time after the Vcc is enabled.

(4) The T4 should be measured the module is fully discharged.

(5) The interface signal shall not maintain the high impedance when the power is on.

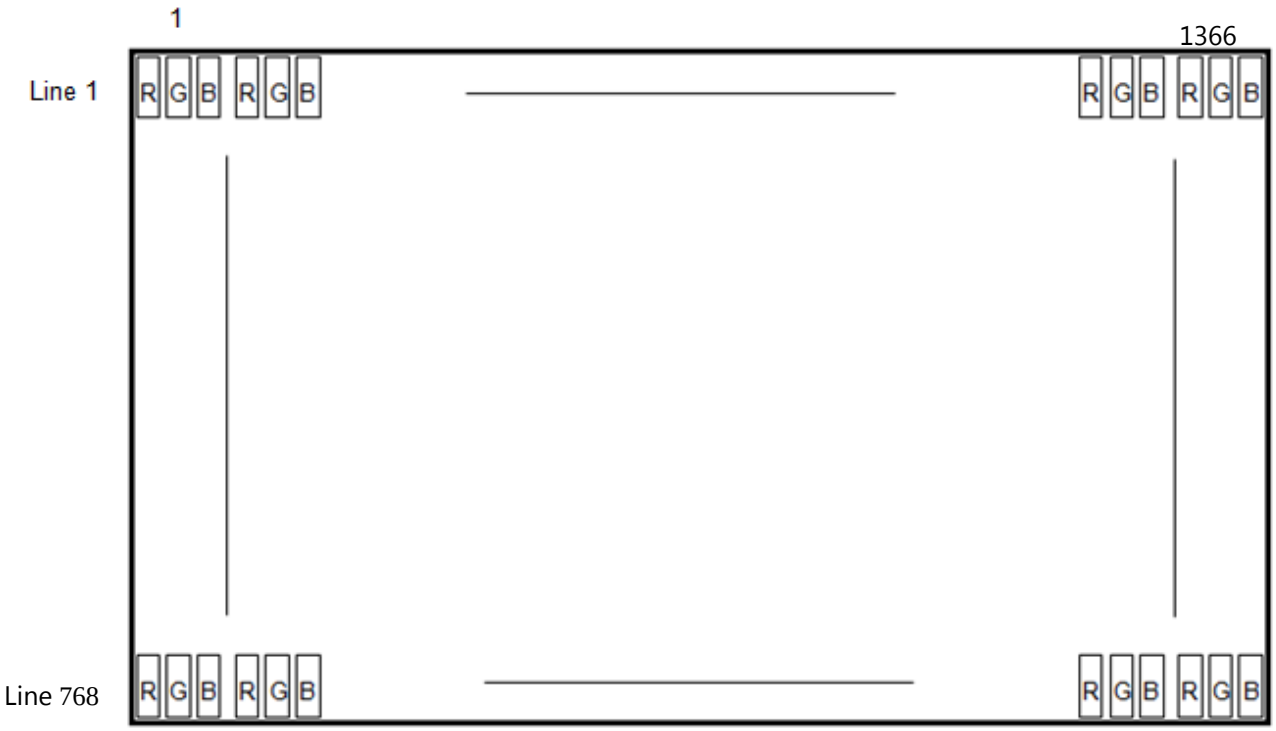
5.8 INPUT TERMINAL PIN ASSIGNMENT

5.8.1 INPUT SIGNAL & POWER

(
(LVDS, Connector : 20455-040E-0, I-PEX or the equipment with the equivalent capability)

Pin	Symbol	Function
1	NC	Hot Plug Detect or No connection (optional)
2	LCD_VCC	LCD logic and driver IC Power(3.3V typ.)
3	LCD_VCC	LCD logic and driver IC Power(3.3V typ.)
4	VCC_EDID	DDC power
5	BIST_EN (WPN)	BIST enable and Reserved for the use by LCD manufacturer. (WPN)
6	CLK_EDID	DDC clock
7	DAT_EDID	DDC data
8	RX0-	Negative LVDS differential data input for pixel
9	RX0+	Positive LVDS differential data input for pixel
10	H_GND	High speed ground
11	RX1-	Negative LVDS differential data input for pixel
12	RX1+	Positive LVDS differential data input for pixel
13	H_GND	High speed ground
14	RX2-	Negative LVDS differential data input for pixel
15	RX2+	Positive LVDS differential data input for pixel
16	H_GND	High speed ground
17	RXC-	Negative LVDS differential clock input for pixel
18	RXC+	Positive LVDS differential clock input for pixel
19	LCD_GND	LCD logic and driver IC Ground
20	NC	No connection
21	NC	No connection
22	LCD_GND	LCD logic and driver IC Ground
23	NC	No connection
24	NC	No connection
25	LCD_GND	LCD logic and driver IC Ground
26	NC	No connection
27	NC	No connection
28	LCD_GND	LCD logic and driver IC Ground
29	NC	No connection
30	NC	No connection
31	BL_GND	Backlight ground
32	BL_GND	Backlight ground
33	BL_GND	Backlight ground
34	NC	Hot Plug Detect or No connection (optional)
35	BL_PWM_DIM	Signal input for the system PWM for dimming
36	BL_ENABLE	Backlight on/off
37	APS_EN	APS on/off or No connection (optional)
38	BL_PWR	Backlight power
39	BL_PWR	Backlight power
40	BL_PWR	Backlight power

6. PIXEL FORMAT



7. OUTLINE DIMENSION

TBD

8. RELIABILITY TEST

Item		Condition	Time/Cycle
HTOL		55 ℃	500 hrs
LTOL		-5 ℃	500 hrs
HTS		70 ℃	500 hrs
LTS		-25 ℃	500 hrs
THB		50 ℃, 90%	500 hrs
WHTS		60 ℃, 75%	500 hrs
T/C		-40 ℃/30min ~ 65 ℃/30min	50 cycles
ESD	Non-operating	CDM : 150pF, 330Ω, 9point, 3 times/point	±10kV
	Operating	Contact : 150 pF, 330Ω, 100point, once/point	±8kV
		Air(non-contact) : 150pF, 330Ω, 100point, once/point	±15kV
Box Vibration (Non-operating)		5~200Hz, 1.05Grms, 2hr/Y	1time
Shock (Non-operating)		240G, 2msec, ±XYZ	30min/axis
HINGE		10~170˚, Open/Close 2sec, Pause1sec	30Kcycle
Altitude		-40~50℃, 0~45,000ft	72.5Hr

[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state,
these should be no change which may affect practical display functions.

9. PACKING

9.1 CARTON

(1) Packing Form

Corrugated Cardboard box and Corrupad form as shock absorber.

(2) Packing Method

Note (1) Total Weight : Approximately 18 Kg

(2) Acceptance number of piling : 36 sets

(3) Carton size : 373(W) × 470(D) × 372(H))

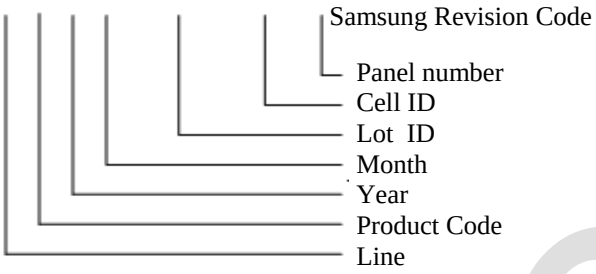
(3) Packing Material

No	Part name	Quantity
1	Static electric protective sack	36 pcs
2	Packing case (Inner box) included shock absorber	1 set
3	Pictorial marking	2
4	Carton	1 set

9.2 MARKING

A nameplate is affixed to the specified location on each product.

(1)Parts number : LTN156AT34
(2)Revision code : 3 letters
(3)Lot number : X X X X XXX XX X D01



(4) Nameplate Indication

Parts name : LTN156AT34
Lot number : XXXXXXXXXX
Inspected work week : 1304 (2013 year 4th week)
Product Revision Code : D01
DP/N : Dell Part No ("**0PT8JP**" is for LTN156AT34-D)

※ Panel revision code scheme (Refer to the Red box on the label)

Build Name(s)	Revision Code(s)
SST (WS)	X00, X01, X02, … X09
PT (ES)	X10, X11, X12, … X19
ST (CS)	X20, X21, X23, … X29
XB (MP)	A00, A01, A02, … A99

(5) Packing small box attach

TBD

10. GENERAL PRECAUTIONS

10.1 HANDLING

(a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and CCFT back-light.

(c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(f) The desirable cleaners are water, IPA (Isoprophyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth .In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(h) Protect the module from static , it may cause damage to the C-MOS Gate Array IC.

(i) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(j) Do not disassemble the module.

(k) Do not pull or fold the LED FPC.

(l) Do not touch any component which is located on the back side.

(m) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(n) Pins of I/F connector shall not be touched directly with bare hands.

10.2 STORAGE

We highly recommend to comply with the criteria in the table below.

ITEM	Unit	Min.	Max.
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	35	75
Storage Life	12 months		
Storage Condition	- The storage room should be equipped with a good ventilation facility, which has a temperature controlling system. - Products should be placed on the pallet, which is away from the wall not on the floor. - Prevent products from being exposed to the direct sunlight, moisture, and water.; Be cautious not to pile the products up. - Avoid storing products in the environment, which other hazardous material is placed. - If products are delivered or kept in the storage facility more than 3 months,we recommend you to leave products under the condition including a 20℃ temperature and a humidity of 50% for 24 hours. - If you store semi-manufactured products for more than 3 months, bake the products under the condition including the 50℃ temp. and the 10% humidity for 24hrs after being used.		

10.3 OPERATION

(a) Do not connect, disconnect the module in the " Power On" condition.

(b) Power supply should always be turned on/off by following item 6.3 " Power on/off sequence ".

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

(d) The FPC cable between the LED chips and its converter power supply shall be a minimized length and be connected directly .The longer cable between the back-light and the converter may cause lower luminance of light source (LED).

(e) The standard limited warranty is only applicable when the module is used for general notebook applications. If used for purposes other than as specified, SEC is not to be held reliable for the defective operations. It is strongly recommended to contact SEC to find out fitness for a particular purpose.

10.4 OTHERS

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, Variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.

(d) If the module displays the same pattern continuously for a long period of time, it can be the situation when The image “sticks” to the screen.

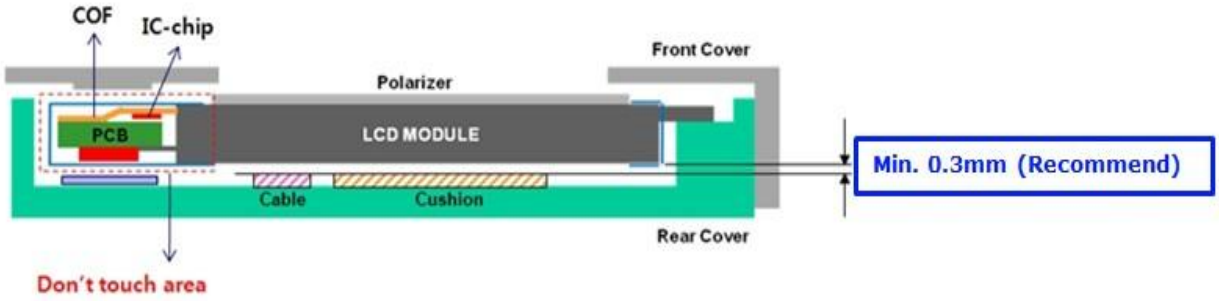
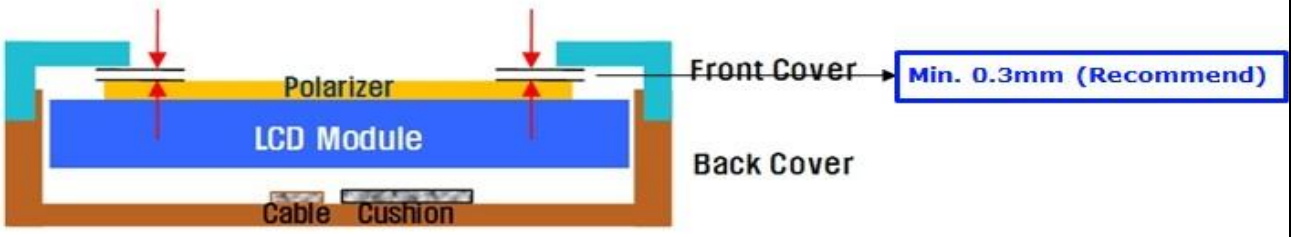
(e) This module has its circuitry PCB’s on the rear side and should be handled carefully in order not to be stressed.

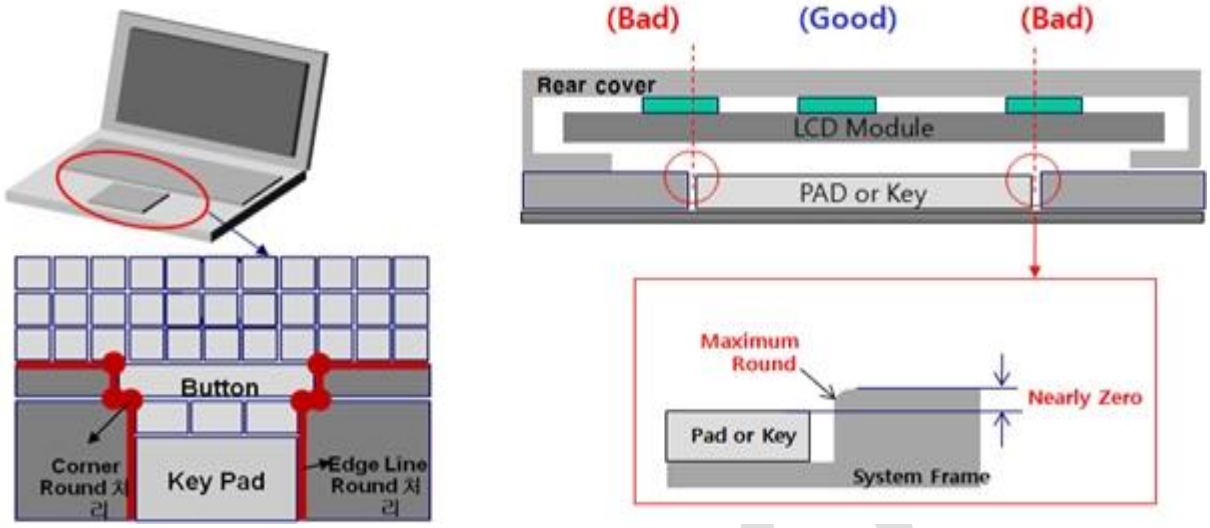
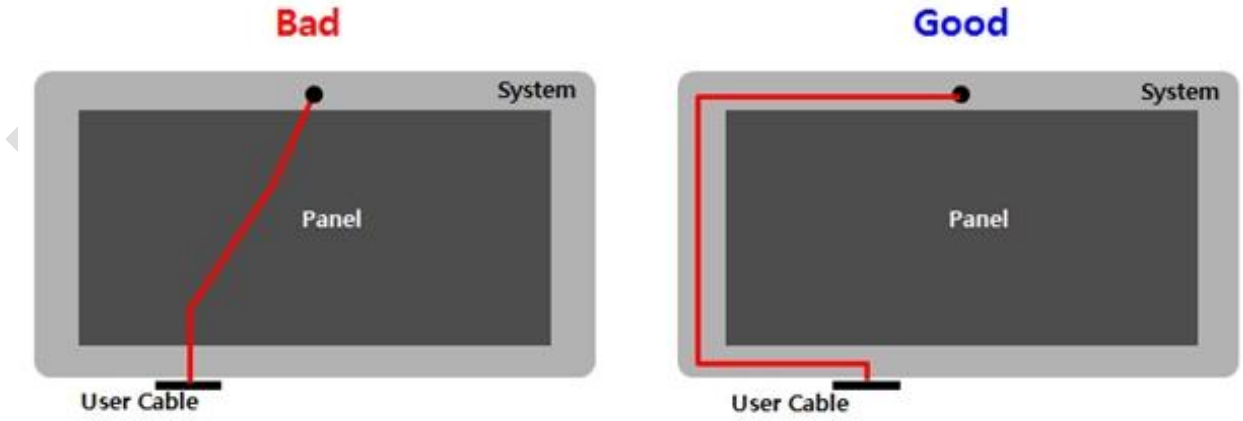
11. EDID

TBD

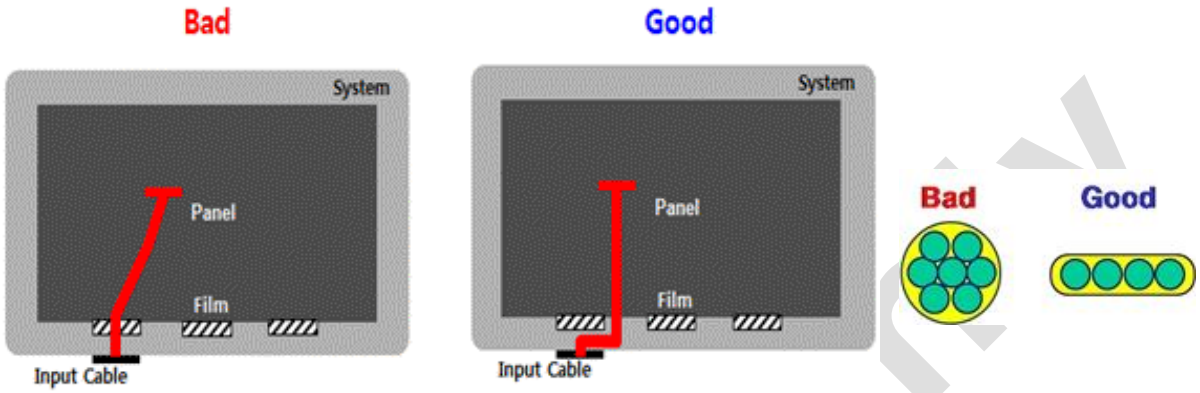
12. APPENDIX

12.1 SYSTEM DESIGN GUIDE

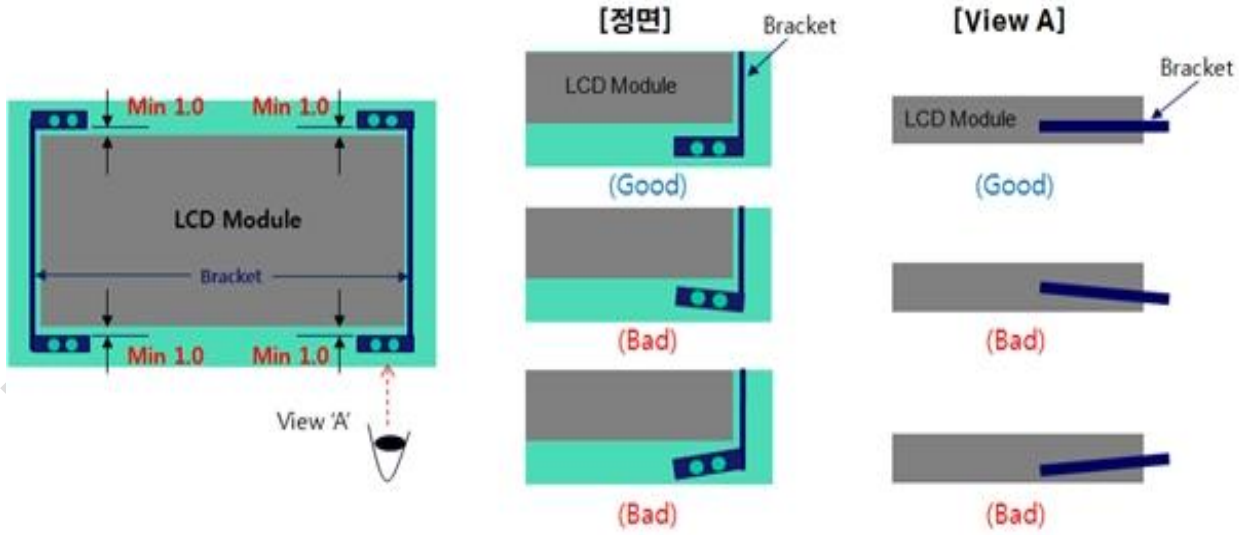
1	[Common]Gap in the rear of display
	Prevent the product from being defected resulted from the interference and the lack of gap between the rear cover of system and the LCD module.
	
Recommendation	A. The gap between the rear cover of system and the rear of LCD module. : Min. 0.3mm (Recommend) B. Based on the size of part in a maximum size between the rear cover of system and the LCD module. : Min. 0.3mm (Recommend) (※ Based on the maximum thickness of module, which the tolerance is considered.)
Risk factor	Pooling / White Spot / Being divided
2	Gap in the front of display
	Prevent the product from being defected resulted from the interference and the lack of gap between the front cover of system and the LCD module.
	
Recommendation	gap between the front cover of system and the front of LCD module. : Min. 0.3mm (Recommend) (※ Based on the maximum thickness of module, which the tolerance is considered.)
Risk factor	Pooling

3	[Common] The shape of key pad of system
	Prevent the product from being defected resulted from the shape of key pad in the system.
	
Recommendation	A. Make the shape of frame, which surrounds the key pad as round as possible. B. Prevent the product from being defected resulted from the pressurization by attaching the sponge on the cover of system not to be overlapped with the position of the frame around key pad. C. Prevent the product from being defected, which is resulted from the pressurization from outside by eliminating the difference in height between the key pad and the frame around key pad.
Risk factor	White Spot / Black Spot / Being broken in glass.
4	[Common] The arrangement of user cable (Camera, Antenna)
	Prevent the product from being defected resulted from the user cable arranged on the rear of module.
	
Recommendation	A. Arrange the user cable in the side not in the rear(the active area) of LCD module.
Risk factor	Pooling / White Spot

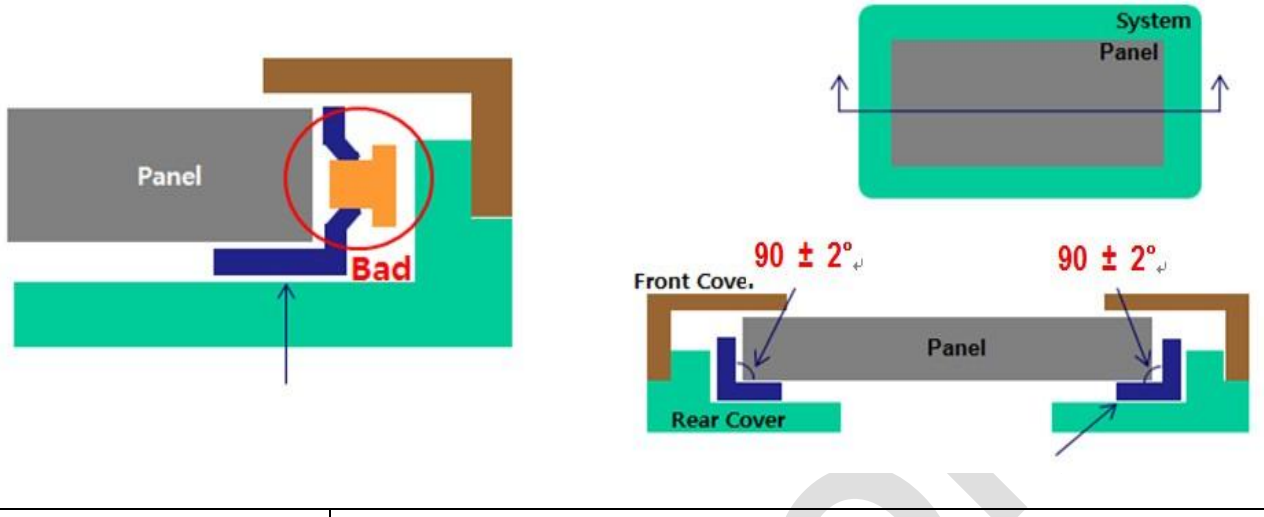
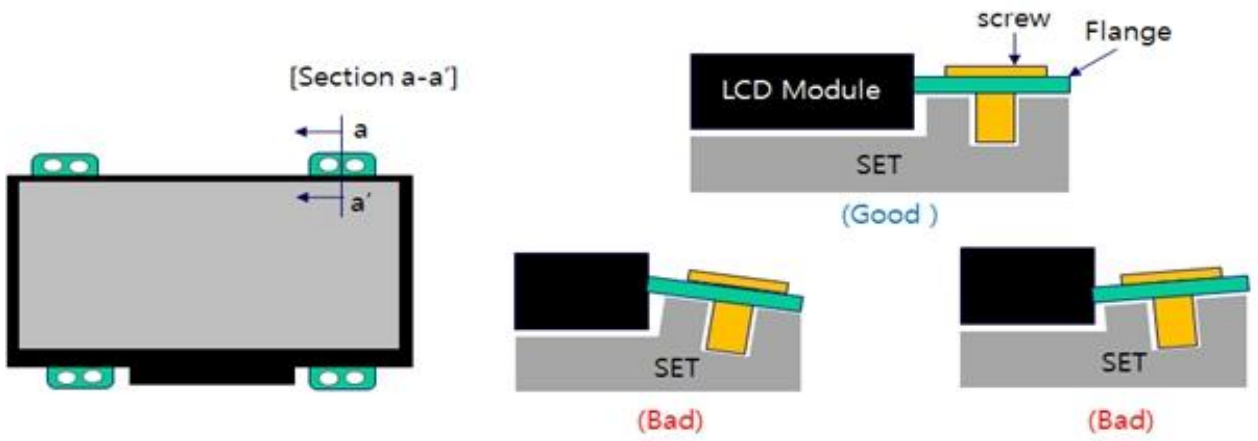
5	[Common] The arrangement of input cable Prevent the product from being defected resulted from the overlapping between the input cable and the film of LCD module .



Recommendation	A. Arrange the input cable not to be overlapped with the COF film. B. Minimization of the height of input cable and making the COF film flat.
Risk factor	A/D (The damaged COF film is cracked., The chip is broken.)
6	[ELS] Gap between the bracket and the LCD Module Prevent the LCD module from being interfered when testing the product in terms of the performance of hinge and the occurrence of twist.



Recommendation	A. Secure the min. 1.0mm distance between the bracket and the LCD module at 4 corners of screen respectively. B. Control the angle of bracket on the system.

7	[ELS] Suggestion on the angle of bracket Prevent the product from being defected resulted from the changed top chassis by the angle and the shape of bracket on the system.
	
Recommendation	A. Don't form the bracket hole. B. Control the angle in the event that the bracket, which has L-shape is applied. (90 ± 2˚)
Risk factor	Pooling / Light leakage
8	[UMS] Control the angle of the connected part on the user flange Prevent the user flange from not being placed horizontally, which is caused when the LCD module, which is structured in UMS is assembled.
	
Recommendation	A. Prevent the product from being pooled resulted from the changed user flange created when assembling the LCD module to the system. B. Insert the screw to the hole of flange vertically when LCD module is assembled to the system.
Risk factor	Pooling